



HEAD AND NECK CANCER REHABILITATION

Leah Mackie MSLP, CCC-SLP

A LITTLE ABOUT ME

I have been an SLP for 31 years
Specialized in Head and Neck Cancer for
21 years.

Certified trismus therapist

Certified Head and Neck Lymphedema
Therapist

Myofascial training

21 years experience placing Tracheo-
esophageal speaking valves

I have been an American for almost 3
years now!



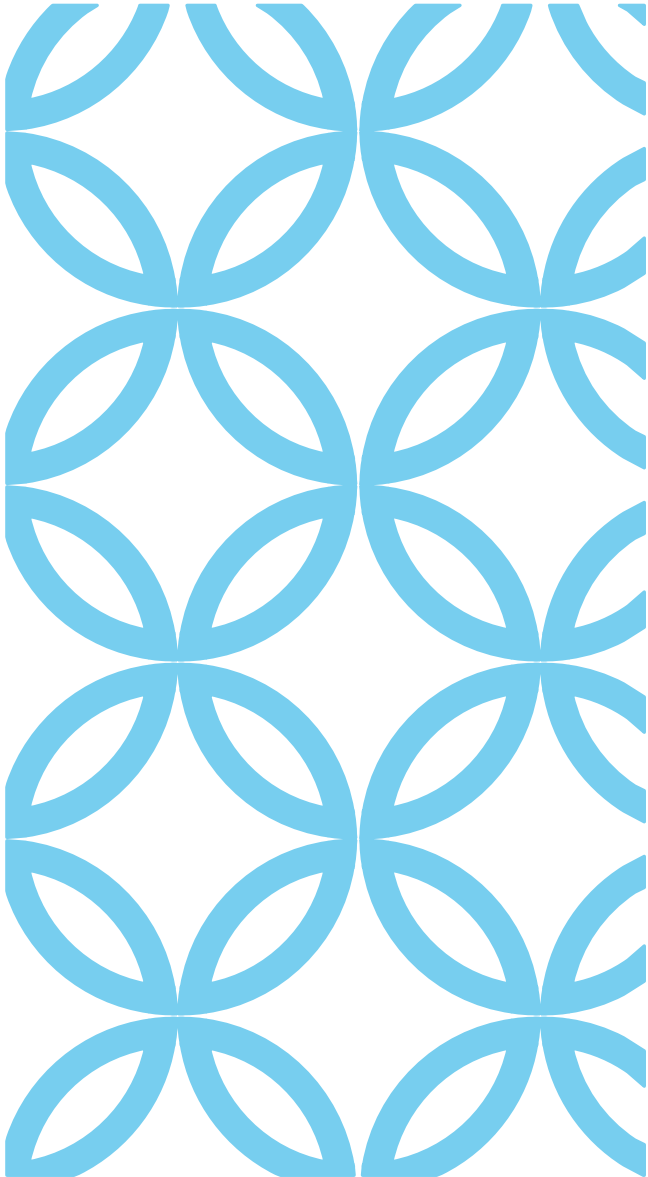
INCIDENCE AND CAUSES

These anatomically related cancers are collectively the sixth most common type of cancer worldwide

The vast majority (>90%) of cancers of the oral cavity and oropharynx are squamous cell carcinomas (SCCs)

Over the last 30 years, oral cavity cancer incidence rates in the USA have decreased in conjunction with decreases in cigarette smoking and alcohol consumption. In contrast, incidence rates for oropharyngeal cancer have been increasing over the same time period suggesting that other risk factors independent of the traditional ones may be at play. Indeed, human papillomavirus (HPV) has been found to be a major etiological factor associated with oropharyngeal cancers with recent North American studies having detected HPV in up to 80% of oropharyngeal cancers and HPV type 16 observed in approximately 90% of HPV-positive oropharyngeal cancers

Weatherspoon, D. J., Chattopadhyay, A., Boroumand, S., & Garcia, I. (2015). Oral cavity and oropharyngeal cancer incidence trends and disparities in the United States: 2000–2010. *Cancer epidemiology*, 39(4), 497-504.



TNM

T = tumor size

N = nodal involvement

M = metathesis (spread to other regions in the body)

The range for tumor size is 1-4

The Nodal involvement is 1-3

Metathesis is limitless

You may see staging such as T3N2bMo in the charting

TUMOR STAGING

TUMOR STAGING IN ORAL CAVITY

T1: Tumor is 2 cm (about $\frac{3}{4}$ inch) across or smaller

T2: Tumor is larger than 2 cm across, but smaller than 4 cm (about 1 $\frac{1}{2}$ inch)

T3: Tumor is larger than 4 cm across

T4a: Tumor is growing into nearby structures. This is known as *moderately advanced local disease*.

For oral cavity cancers: the tumor is growing into nearby structures, such as the bones of the jaw or face, deep muscle of the tongue, skin of the face, or the maxillary sinus

For lip cancers: the tumor is growing into nearby bone, the inferior alveolar nerve (the nerve to the jawbone), the floor of the mouth, or the skin of the chin or nose.

For oropharyngeal cancers: the tumor is growing into the larynx (voice box), the tongue muscle, or bones such as the medial pterygoid, the hard palate, or the jaw.

T4b: The tumor has grown through nearby structures and into deeper areas or tissues. This is known as *very advanced local disease*. Any of the following may be true :The tumor is pterygoid plates and/or the skull base The tumor surrounds the internal carotid artery (for any oral cavity or oropharyngeal cancer.

For lip and oral cavity cancers: the tumor is growing into an area called the masticator space

.For oropharyngeal cancers: the tumor is growing into a muscle called the lateral pterygoid or into the nasopharynx (the area of the throat that is behind the nose).

TUMOR STAGING IN THE LARYNX

T1 Tumor limited to the vocal cord(s) (may involve anterior or posterior commissure) with normal mobility.

- T1a Tumor limited to one vocal cord.
- T1b Tumor involves both vocal cords.

T2 Tumor extends to supraglottis and/or subglottis and/or with impaired vocal cord mobility.

T3 Tumor limited to the larynx with vocal cord fixation and/or invasion of paraglottic space and/or inner cortex of the thyroid cartilage.

T4a Moderately advanced local disease.

- Tumor invades through the outer cortex of the thyroid cartilage and/or invades tissues beyond the larynx (e.g., trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid, or esophagus).

T4b Very advanced local disease.

- Tumor invades prevertebral space, encases carotid artery, or invades mediastinal structures.

TUMOR STAGING IN THE NECK

NX: Regional lymph nodes cannot be assessed.

N0: No evidence of regional lymph node metastasis.

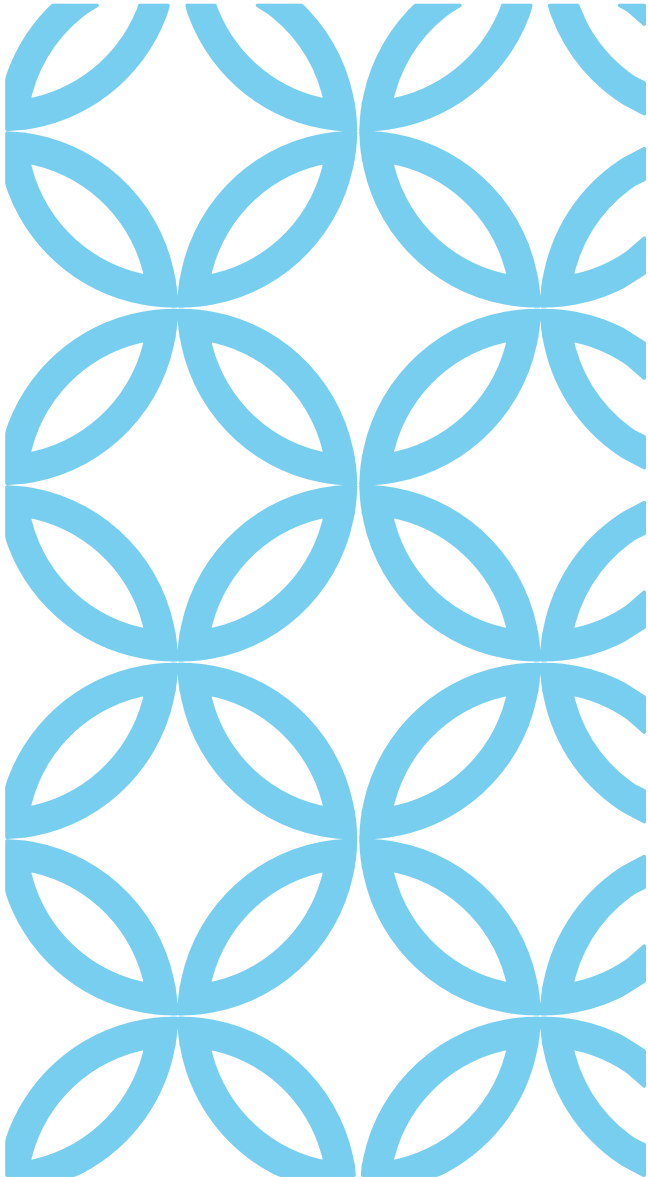
N1: Metastasis in a single ipsilateral (same side) lymph node, 3 cm or less in size.

N2a: Metastasis in a single ipsilateral (same side) lymph node more than 3 cm but not more than 6 cm in greatest dimension.

N2b: Metastasis in multiple ipsilateral (same side) lymph nodes, none more than 6 cm in greatest dimension.

N2c: Metastasis in bilateral (both) or contralateral (opposite side) lymph nodes, none more than 6 cm in greatest dimension.

N3: Metastasis in a lymph node more than 6 cm in greatest dimension.



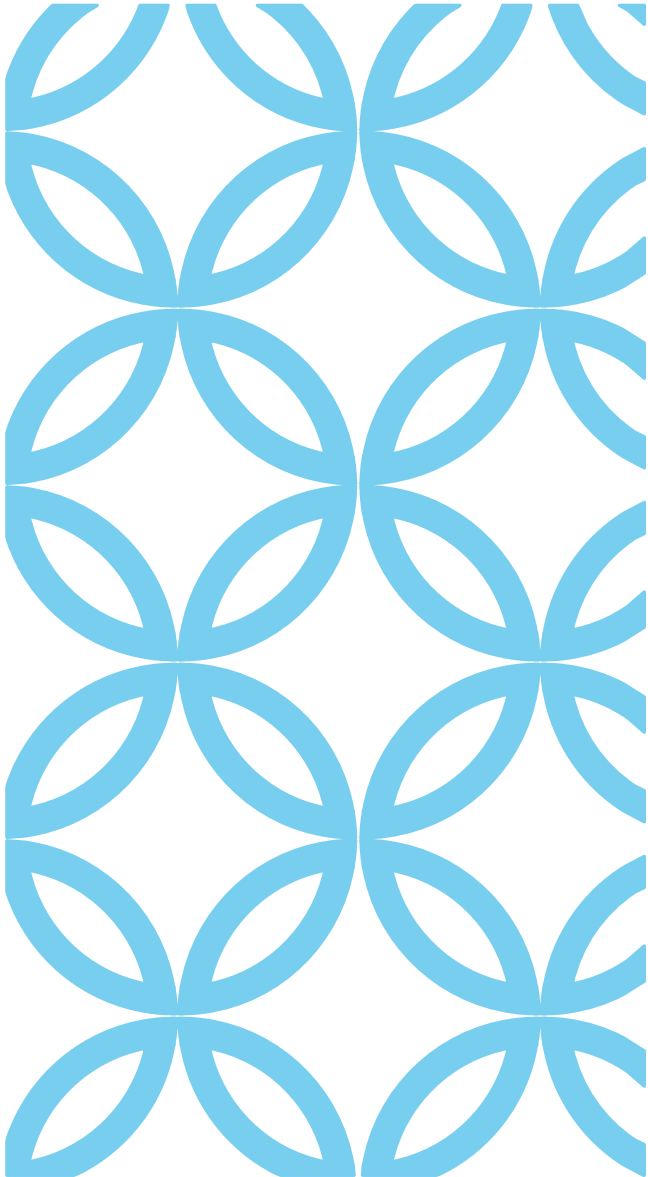
Oral Pharyngeal and Laryngeal cancers that are not recurrent are often treated with radiation +/- Chemotherapy

Tonsillar, base of tongue, vallecular, supraglottic and glottic cancers that are T3 (do not invade the thyroid cartilage)

If the tumor is invading critical structures the patient may be a candidate for induction chemotherapy

At BMDACC we see all patient undergoing radiation for pretreatment baseline swallow and trismus evaluation, mbs prn and to teach preventative swallow exercises.

ORAL PHARYNGEAL AND LARYNGEAL CANCERS



Radiation is measured in Gy. Typically oral pharyngeal cancers receive around 6900 Gy.

Treatment effects start at approximately 20 Gy or in the third week of radiation

Mucositis (painful ulcerations and inflammation in the mouth)

Dysphagia (swallowing disorder)

Odynophagia (pain on swallowing)

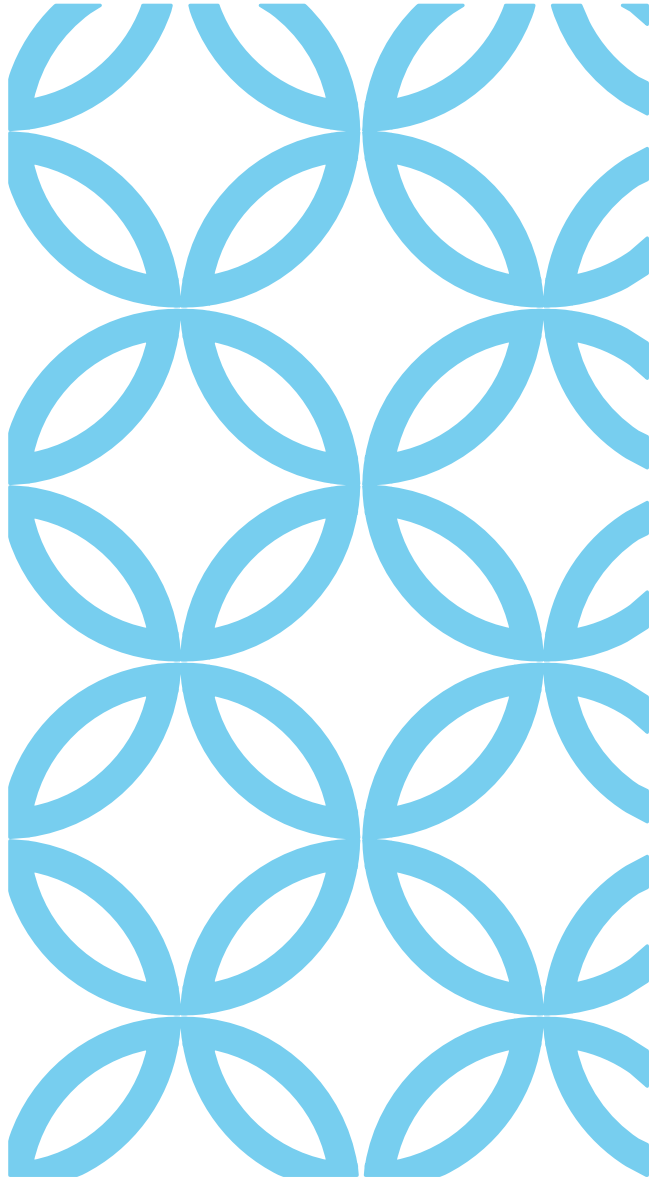
Dysgeusia (taste disturbance)

Xerostomia (dry mouth)

Trismus

Patients are seen pretx, 3rd week tx, 5th week and as needed in the 6/7 and the two weeks post tx.

RADIATION/CHEMOTHERAPY



Swallow exercises are targeted to address individual swallow muscles which may become fibrotic from the radiation

Masako
Mendelsohn
Effortful Swallow
Shaker
Pitch Glides
Chin Stretch
Maximum Jaw Opening 3 finger self measurement.

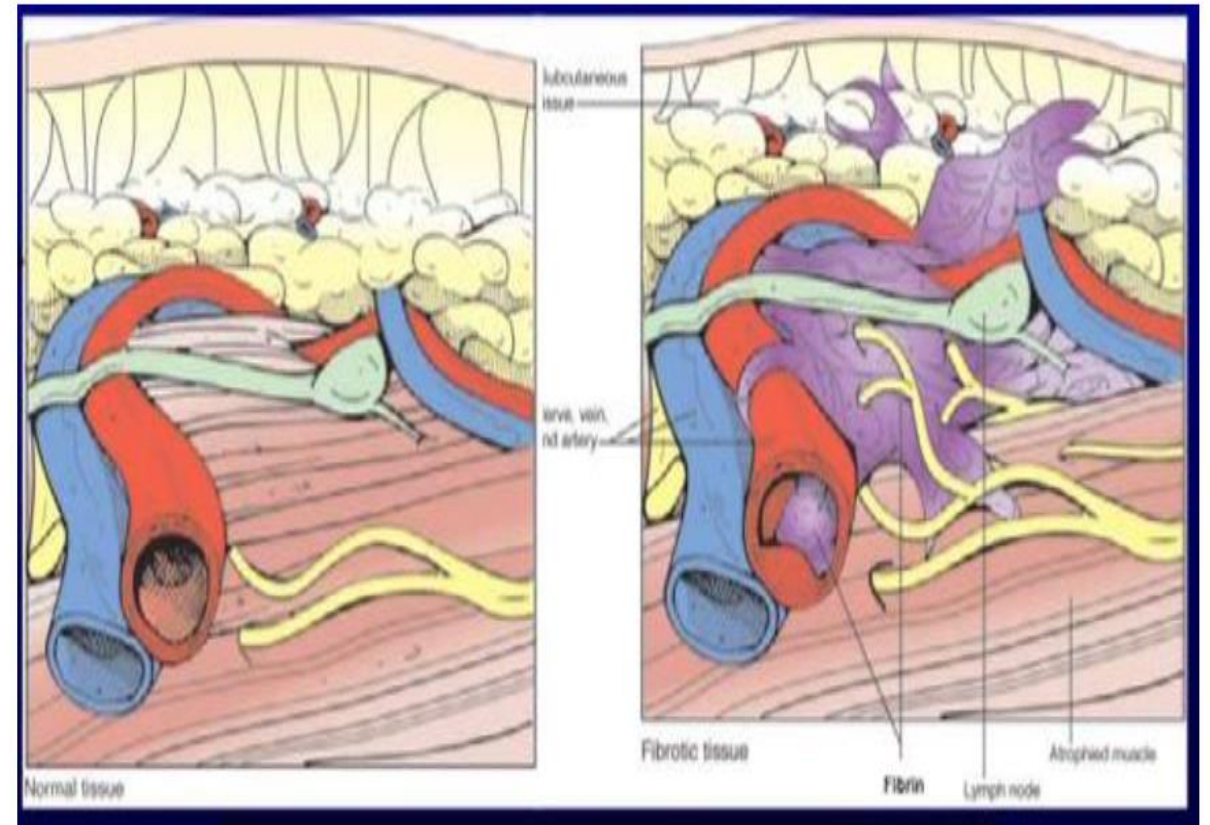
Prescribed these 4x a day with 5 repetitions each

SWALLOW EXERCISES

RADIATION FIBROSIS SYNDROME

1. Pre-fibrotic phase: chronic inflammation endothelial cells
2. An organized fibrosis phase: patchy areas of active fibrosis containing a high density of myofibroblasts in an unorganized matrix
3. Late fibroatrophic phase- retractile fibrosis and gradual loss of parenchymal cells.

RFS can occur weeks/months after radiation and can be progressive years later increasing a patients functional deficits.



OVER-RIDING PRINCIPLE

Eat

HUTCHENSON Use it or Lose it, JAMA-OTO 2013

Patients who maintained full PO during RT or CRT were 2.0 times more likely to eat a regular diet in long term follow up compared to those who were NPO status during treatment.

Proportion of Patients returning to a regular diet after RT or CRT

64% (neither ate or exercises)

77-84% of patients who maintained some swallowing goals (eat or exercise)

92% of patients who met both swallowing goals (eat and exercises)

Helpful Hint: Post this page to your fridge or someplace in the kitchen.

Take a step in the right direction!

Eat All Through Radiation Staircase



Figure 1. EAT Staircase
Reprinted with permission from University Health Network

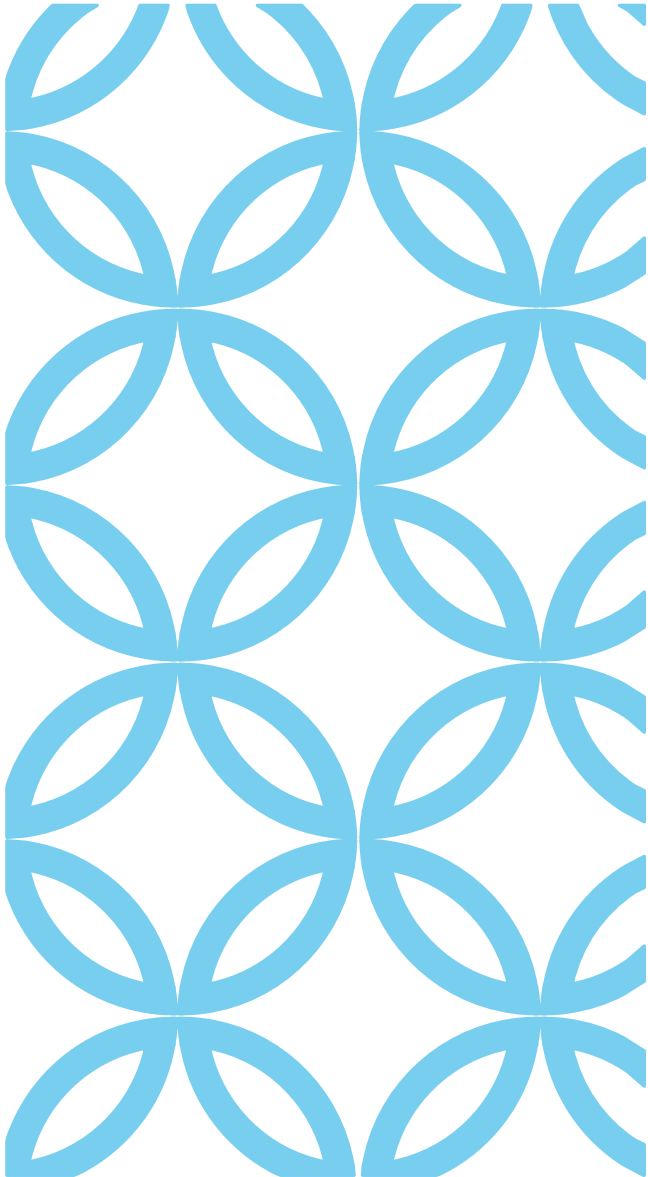
EAT THROUGH RADIATION STAIRCASE



ADHERING TO EAT AND EXERCISE STATUS DURING RADIOTHERAPY FOR OROPHARYNGEAL CANCER FOR PREVENTION AND MITIGATION OF RADIOTHERAPY ASSOCIATED DYSPHAGIA, 2022

Oral intake was independently associated with subacute quality of life, dysphagia severity per videofluoroscopy DIGEST grade, and FT duration/use, while adherence to swallowing exercise was independently associated with better swallowing safety (lesser degree of laryngeal penetration/aspiration) per DIGEST in the short and long term as well as long-term ability to consume a solid diet.

Barbon, C. E., Peterson, C. B., Moreno, A. C., Lai, S. Y., Reddy, J. P., Sahli, A., ... & Hutcheson, K. A. (2022). Adhering to Eat and Exercise Status During Radiotherapy for Oropharyngeal Cancer for Prevention and Mitigation of Radiotherapy-Associated Dysphagia. *JAMA Otolaryngology–Head & Neck Surgery*, 148(10), 956-964.



Varani et al, 2015 Head and Neck RCT

N: 50 patients

2 groups (the exercise group, $n = 26$ and the repetitive swallow group, $n = 24$).

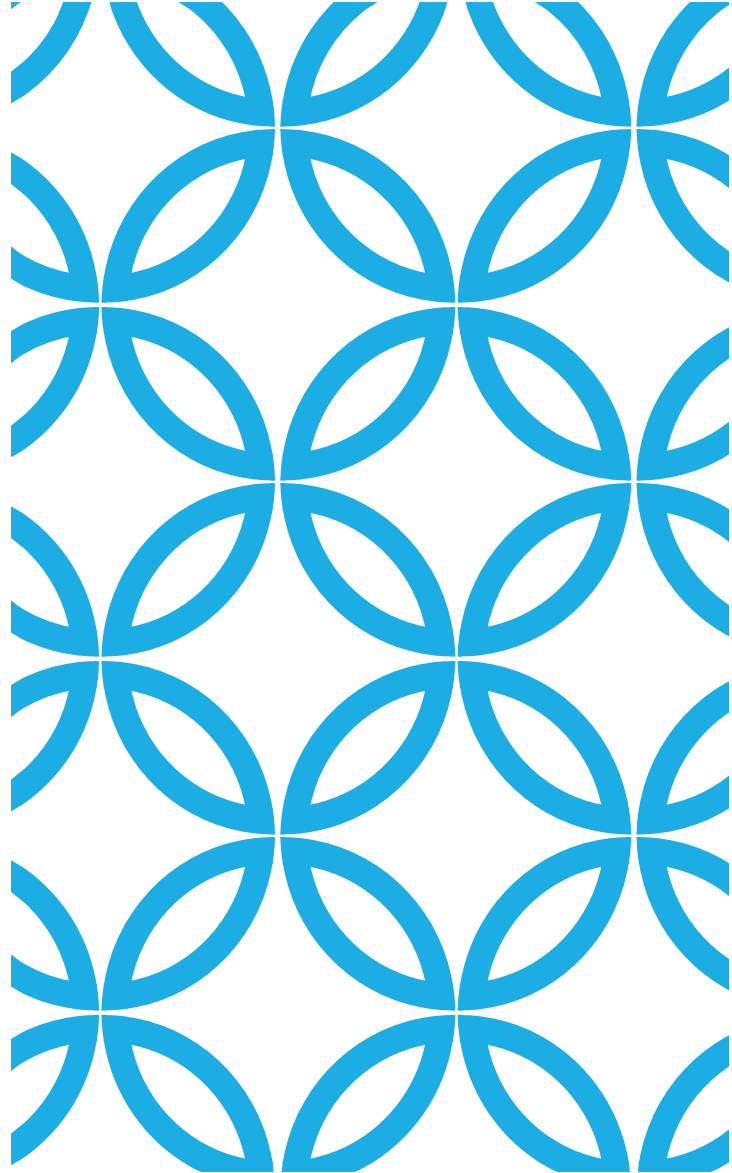
Functional Oral Intake Scale (FOIS) scores and percutaneous endoscopic gastrostomy (PEG) placements were compared A. post treatment B. 3 months.

Outcomes:

Peg tubes post tx: exercise group 35% Swallow group 69%

Peg Tubes 3 months post tx: exercise group 10% Swallow group 50%

WHY SHOULD WE DO IT?



ORAL CANCERS

SURGERY TYPES FOR ORAL CANCER

- Hemiglossectomy: Up to half of one side of the tongue

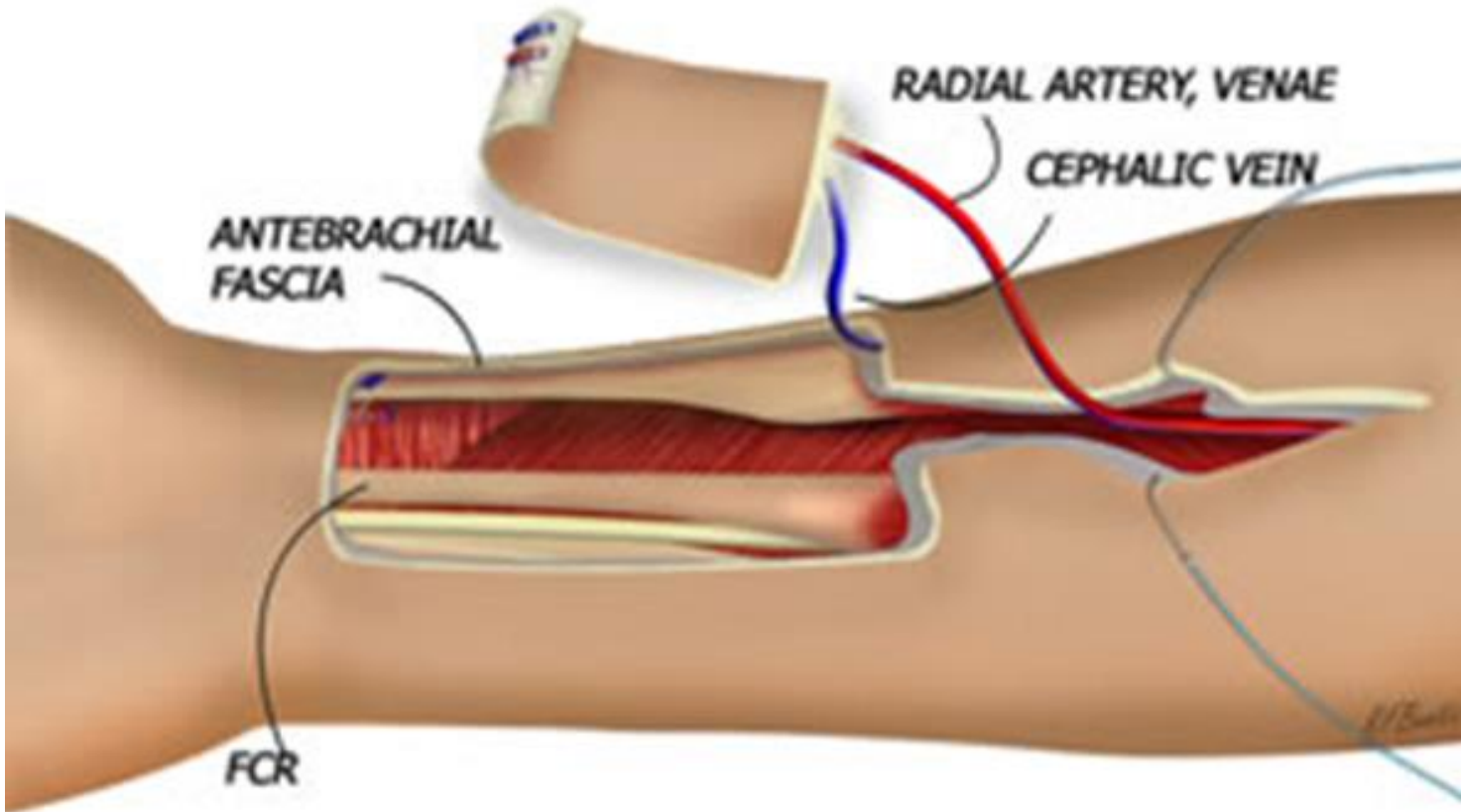
Is reconstructed with a free flap either a Radial Forearm Free Flap or an Anterior Lateral Thigh Flap.

- Total Glossectomy: Removal of entire oral tongue

Will need a larger amount of tissue to reconstruct, so usually ALTF

- Both types of surgeries result in dysphagia and dysarthria which needs rehabilitation





The radial forearm flap is supplied by the radial artery and perforators from the radial artery to the overlying skin. The venae comitans of the radial artery or the cephalic vein can be used for venous drainage.

RADIAL FOREARM FREE FLAP

ANTERIOR LATERAL THIGH FLAP

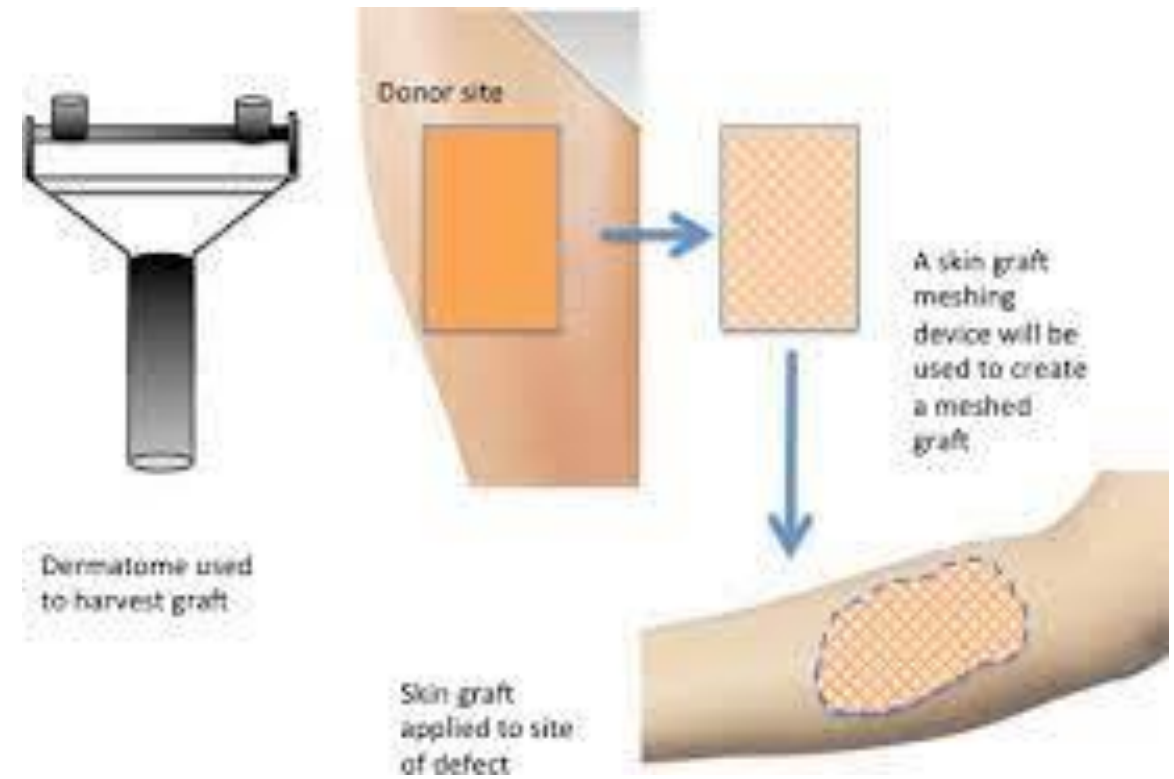
Use when you need larger flap
(total laryngectomy, total
glossectomy)

Uses the femoral artery and its
venae comitantes.



SKIN GRAFT TO THE ARM

At times there will be a split thickness skin graft from the leg to the arm to cover the arteries.



CASE STUDY: HEMIGLOSSECTOMY

52 year old female diagnosed with a T3NoMo SCC of the right oral tongue. She required surgical removal of the tumor and was reconstructed with a radial forearm free flap.

She was NPO immediately post surgery and had a tracheostomy tube and dobhoff tube insitu.



RADIAL FOREARM FREE FLAP

Covered in a split thickness skin graft
from her thigh



The SLP and surgeon deflated the cuff on the trach tube POD 1 and a Passy Muir Valve was placed on the trach once the cuff was deflated.

Edema in the flap presented patient with difficulties keeping her tongue fully in her mouth

Mild articulatory dysarthria with distortions on lingual alveolars, bilabials (as tongue was between lips) and sibilants

Started gentle ROM of the tongue to keep same in midline POD 3.
Addressed lingual alveolars in minimal pairs

She was decannulated POD 6 and discharged home with dobhoff tube



ACUTE CARE TREATMENT

SPEECH AND SWALLOW TX IN OP: STANDARDIZED ASSESSMENTS

Assessment of Intelligibility of Dysarthric Speech

Word Transcription: 88%

Word Multiple Choice: 86%

Sentence Comprehension: 97%

Distortions noted on vowels, sibilants and lingual alveolars on the Goldman Fristoe

Functional Oral Intake Scale¹

TUBE DEPENDENT (levels 1-3)

1 No oral intake

2 Tube dependent with minimal/inconsistent oral intake

3 Tube supplements with consistent oral intake

TOTAL ORAL INTAKE (levels 4-7)

4 Total oral intake of a single consistency

5 Total oral intake of multiple consistencies requiring special

preparation

6 Total oral intake with no special preparation, but must avoid

specific foods or liquid items

7 Total oral intake with no restrictions

QUALITATIVE SCALE

Patient rates their swallowing problem on a scale of 1-4

May also use the MDADI

The purpose of the EAT-10 questions is to help measure swallowing problems. Answer each question by circling the number that matches how bad you feel the problem is for you.

<i>To what degree to you experience the following problems?</i> Circle an answer between 0 and 4	0 = No problem 4 = Severe problem				
1. My swallowing problem has caused me to lose weight.	0	1	2	3	4
2. My swallowing problem interferes with my ability to go out for meals.	0	1	2	3	4
3. Swallowing liquids takes extra effort.	0	1	2	3	4
4. Swallowing solids takes extra effort.	0	1	2	3	4
5. Swallowing pills takes extra effort.	0	1	2	3	4
6. Swallowing is painful.	0	1	2	3	4
7. The pleasure of eating is affected by my swallowing.	0	1	2	3	4
8. When I swallow food sticks in my throat.	0	1	2	3	4
9. I cough when I eat.	0	1	2	3	4
10. Swallowing is stressful	0	1	2	3	4
Add up the sum of the numbers you circled for a TOTAL EAT-10 Score:					

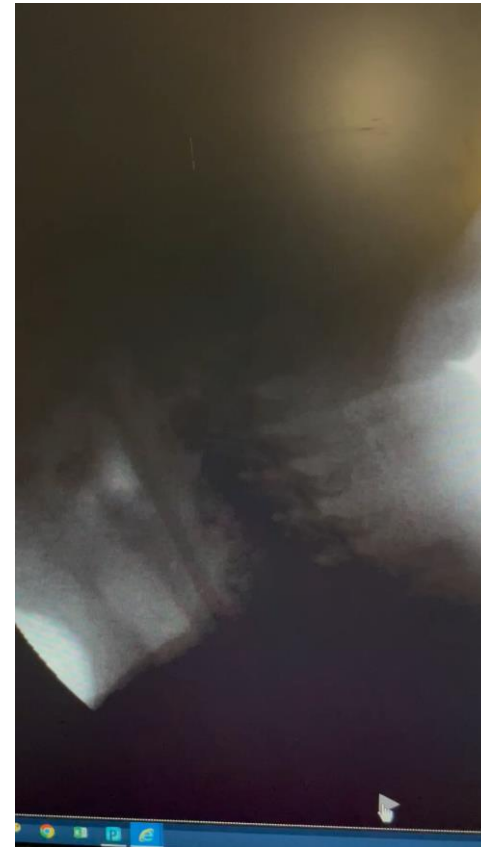
If your score is greater than 3 you may have swallowing problems. We suggest that you share your EAT-10 results with your doctor.

MBS PRIOR TO STARTING ORAL DIET. ALSO LOOKS FOR ANY LEAKS INTO THE FOM

thin



Pureed



POST MBS PT IS STARTED ON FULL LIQUIDS

Therapy addressed the bolus dispersion due reduced lingual range and strength

Oral motor exercises to improve lingual range and to keep tongue at midline

Lymphedema Treatment – decongested the neck to allow the tongue to drain lymphatic fluid into the submental lymph nodes



OP THERAPY

IOPI (Iowa Oral Performance Instrument) once healed:

Initial score was 29 kPa. Range is 40-80kPa and average is 63kPa.

Articulation therapy to address vowel distortion and sibilant and lingual alveolar production

Worked on lateralization and lingual control over a bolus to try to progress towards pureeds, minced and eventually solids.



RADIATION COMMENCED 4 WEEKS POST SURGERY

Patient was advanced to a pureed diet as her oral propulsion improved clinically. She was also taught the prophylactic swallowing exercises which have been shown to improve long term outcomes in diet level and swallow safety



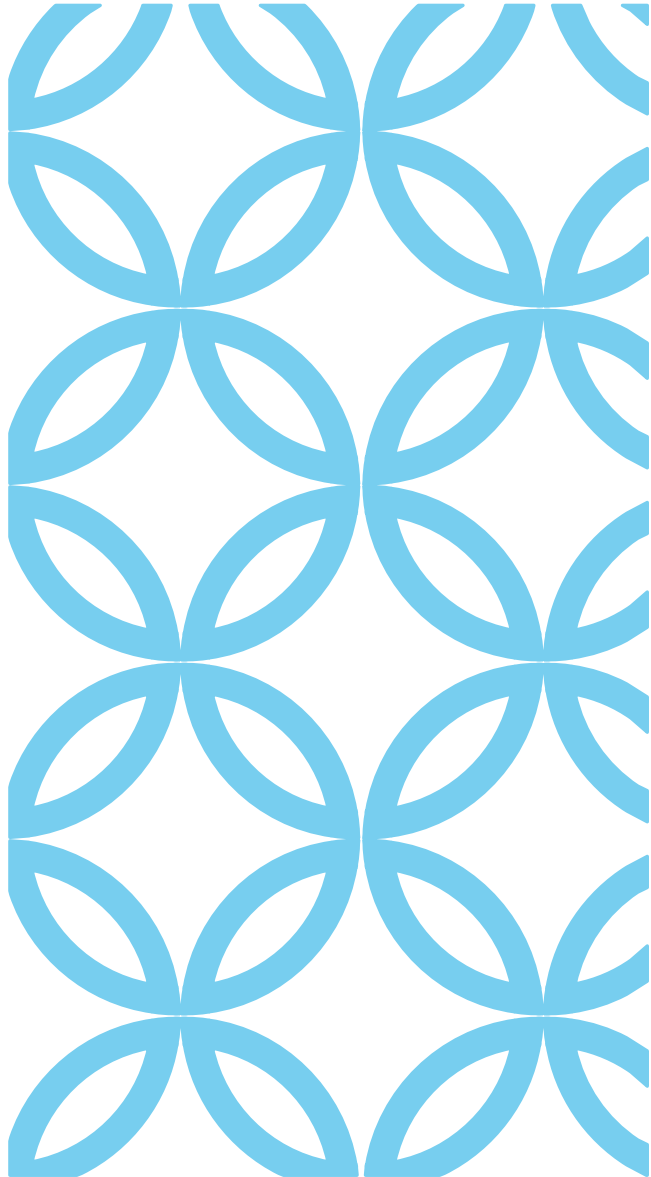
PATIENT FINISHES RADIATION



ONCE HEALED FROM THE ACUTE RADIATION TOXICITIES THERAPY RESUMES

She is advanced to a regular solid food and thin fluid diet
She continues to improve her articulation and oral motor strength and range
Commences voice therapy with easy onset with pitch reset, Conversational Therapy and pitch Glides.
Continues with swallow exercises for one year

Her D/C measures are
FOIS improved from a 1 to a 7
PSS- HNC improved from 110 to 290/300 (She continues to need a liquid wash)
IOPI improved from 29kPa to 54kPa
Able now to keep her tongue at midline



POST TREATMENT ONE YEAR



SURGERY TYPES FOR ORAL CANCER

Mandibulectomy

- Removal of part or the whole mandible
- Includes the teeth, (may include the saliva glands, floor of the mouth)
- Requires bony reconstruction.

- Will need rehabilitation for dysphagia and dysarthria

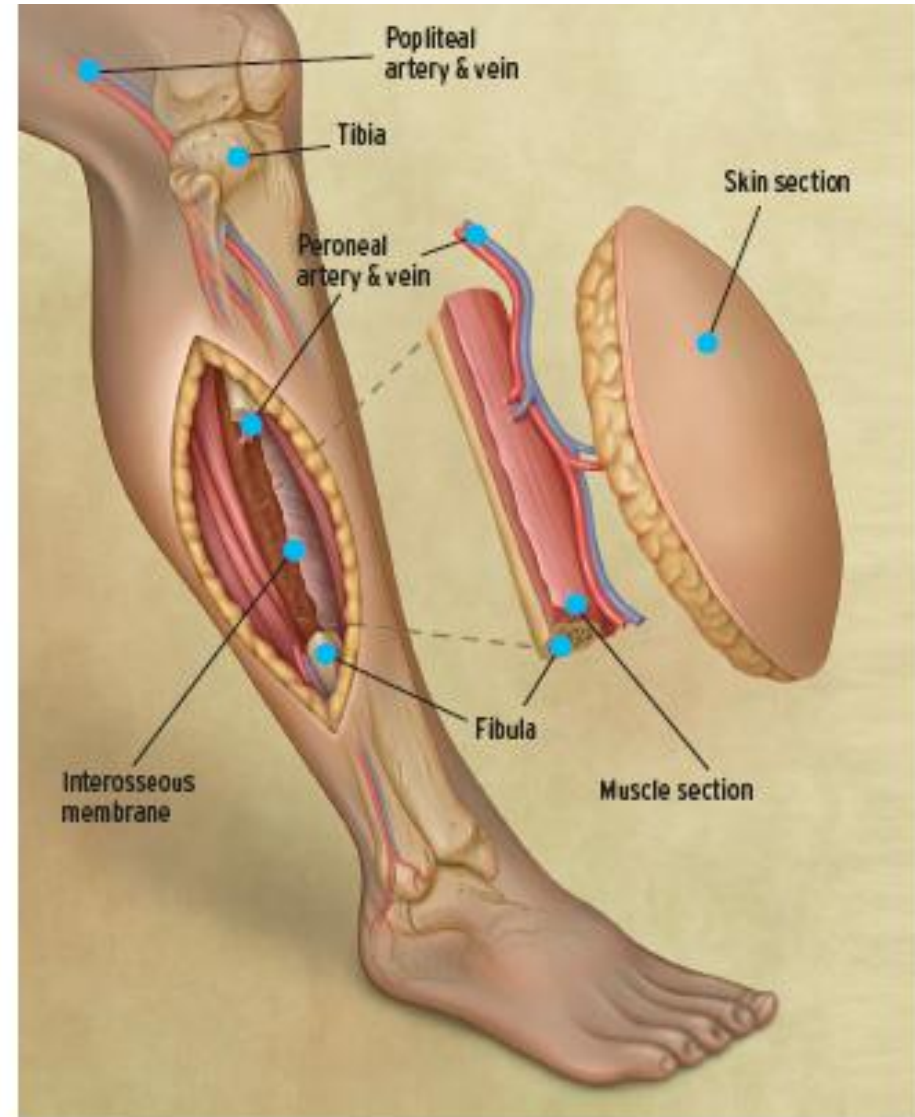
FIBULAR FREE FLAP

Osseocutaneous Flap – used to reconstruct the mandible

Fibula is non WB bone

Can use up to 26 cm can be taken without affecting function

A segment of bone is preserved distally and proximally to support the ankle and preserve the peroneal nerve, respectively

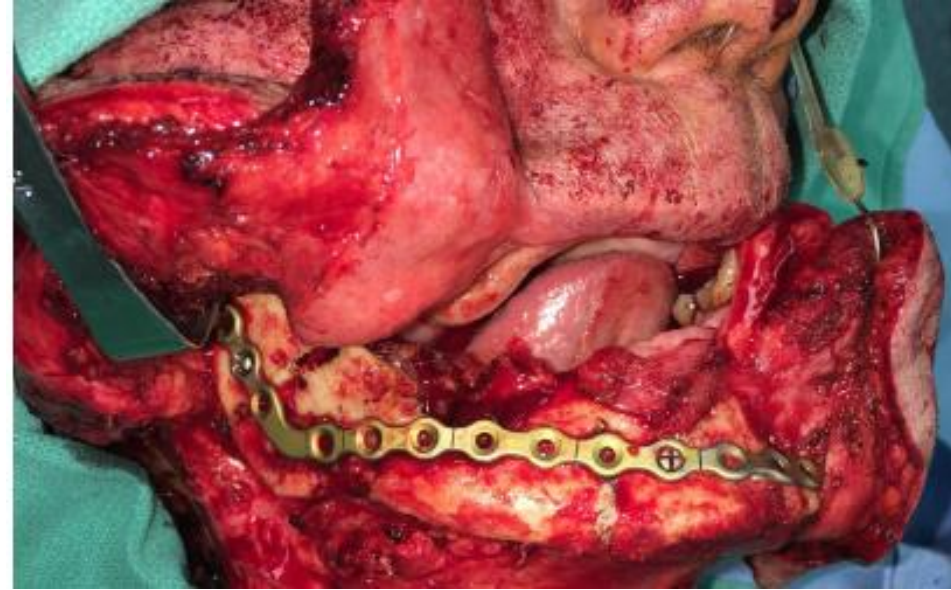


Fibular free flap

Free Flap Reconstruction for the Mandible.



Titanium Plate to Stabilize the flap



SURGERIES- MANDIBULECTOMY

CASE HISTORY

61 year old female diagnosed with T4aN2cMO SCC of the anterior oral tongue.

Surgery included composite resection of the mandible from midbody to midbody, the floor of mouth and anterior partial glossectomy. Bilateral neck dissection, g-tube placement with tracheostomy tube placement. OR note states spared bilateral hypoglossal nerves to base of tongue



TWO PART RECONSTRUCTION

First day: Fibular free flap to
reconstruct the mandible
Second day: Radial Forearm
Free Flap to reconstruct the
tongue



THE RESECTION AND PLACEMENT OF FIBULAR FLAP FOR THE JAW RECONSTRUCTION FIRST DAY



SECOND DAY, RECONSTRUCTION OF THE TONGUE AND FLOOR OF THE MOUTH



FOREARM RECONSTRUCTION TO THE TONGUE



ACUTE CARE THERAPY

Patient has her cuff on the trach tube deflated and she is taught finger occlusion at first due to edema in flap a which is partially blocking the upper airway and preventing full exhalation, stacking

She is discharged on full tube feeds through the g-tube and with a PMV on the trach tube.

Is decannulated after 24 hour plugging trial in clinic 3 weeks post surgery

OP SPEECH THERAPY

Standardized Measures

FOIS: 1

PSS-HNC: 25/300

EAT-10 19/40

AIODS:

Word Transcription: 70%

Word Multiple Choice 72%

Sentence Intell: 90%

She had severe trismus post surgery and her MJO was 27 edentulous so adjusted to 7mm.

IOPI: 13kPa!

OP MBS conducted 4 weeks post surgery



COMMON SIDE EFFECTS: TRISMUS

- Tonic Contraction of the muscles of mastication
- Restriction of mouth opening
- < 35mm in the head and neck oncology patient
- Prevalence varies depending on studies
- Van der Geer et al (2018)
 - n730 patients
 - Prevalence was 23.6%
 - Factors associated were older age, tumors of the maxilla, mandible, cheek major salivary glands or oropharynx, repeated irradiation and chemotherapy



- National Cancer Institute – SOMA
 - Subjective, Objective, Management, Analysis
 - classification of late cancer therapy toxicities
 - 20–30mm – grade 1
 - 10–20mm – grade 2
 - 5–10mm – grade 3
 - <5mm – grade 4

TRISMUS MEASUREMENT AND CLASSIFICATION

Normal Mandibular range of motion is 35-45mm

TRISMUS

Carnaby-Mann et al studies 58 HNC patient tx with Chemorad

- Three groups, usual care, sham swallow intervention, active swallow exercise including therabite.
- Mouth opening after 6 weeks post cancer treatment was significantly better in the active group: Usual care: 32.3mm, Sham 34.1mm and Exercise: 40.1mm

Rapidis et al. 2015

- Systemic Review
- Concluded that exercises therapy is the mainstay of the treatment of trismus and should start as soon as possible (ie after surgery, and during RT) indicating that prevention of trismus, rather than it's treatment is the most important objective.
- Notes that if mouth opening decreases despite exercises especially when it is associated with pain, then recurrence must be seriously considered.



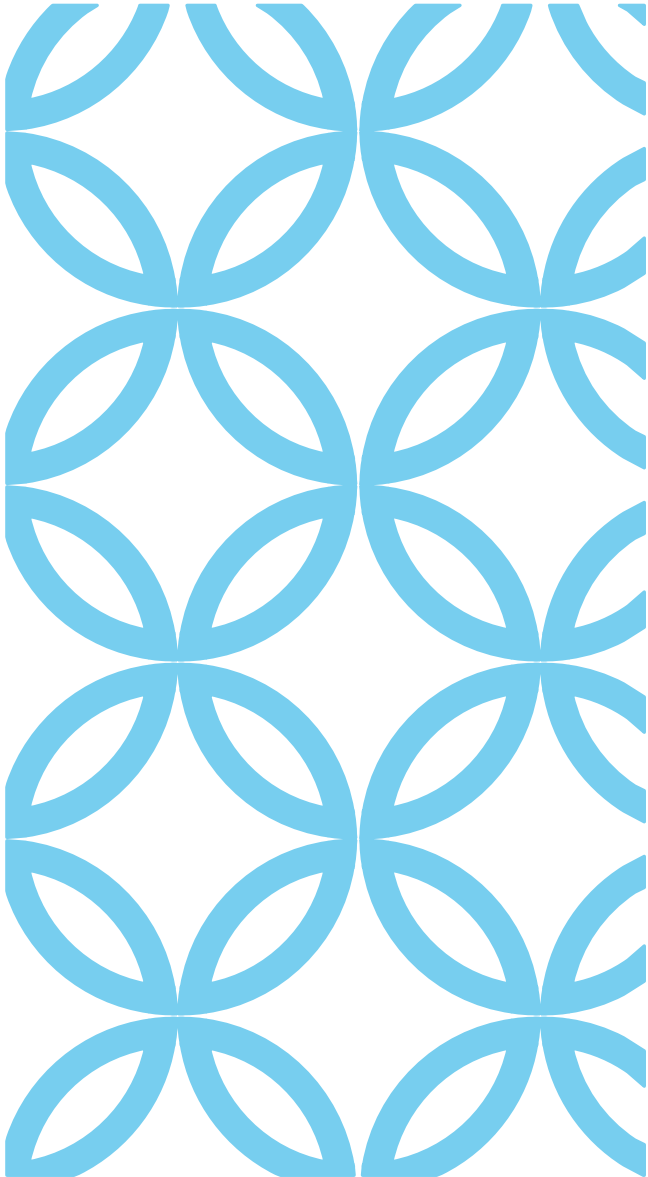
PATIENT STARTS CHEMORADIATION 6 WEEKS POST SURGERY.

Taught pt to fade the head back and slurp and swallow that she initially needed to propel the bolus. Oral motor exercises with remaining 1/3 posterior tongue which was fully innervated.

Started on 4 oz of thinned pureed and thin fluids with a super supraglottic swallow prior to radiation

Taught pt swallow exercises but also need trismus program due to severe reduction in maximum jaw opening.

Addressed severe articulatory dysarthria focusing on lingual alveolars, velars and sibilants



Pt has 6 weeks of radiation and with weekly chemotherapy. She continues with her tube feeding but loses weight on same due to severe nausea

She continues to complete her swallow exercises and continues to drink water through out the radiation.

After radiation she leaves Phoenix and returns to Lake Havasu where she has no therapy.

PATIENT FINISHES CHEMORADIATION

PT RETURNS TO THERAPY 4 MONTHS POST CHEMORADIATION

Patient decides to move the Phoenix to be closer to therapy and attends weekly speech therapy and 3x a week lymphedema therapy.

On re-eval patient has radiation fibrosis to the fascia in the neck and over the larynx and her SCM are tightening up pulling her whole head into a forward posture. She is only taking 4 oz of water a day and her tongue is largely immobile

Pt starts Myofascial therapy to address the fibrosis and trismus therapy as she wants to improve her MJO for dental rehabilitation as part of the speech therapy

Oral motor exercises and IOPI were used to help improve her ability to move the anterior tongue flap with the remaining tongue.

Articulation therapy is focused heavily addressing lingual alveolars, velars and vowel distortions. Minimal pairs used to contrast and build on existing sounds

PO trials and teaching compensatory strategies, (SSG, alternating liquids and purees, improving lingual alveolar contact and then a sweep. Commenced weaning from the g-tube

OUTCOMES

Fois improves from a 1 to a 5

PSS-HNC improves from 25/300 to 200 (diet level 50, public eating 75, speech intelligibility: 75)

IOPI improves from 13kPa to 56 kPa

AIODS: Sentence Intell:97%
Word Transcrip. 90%
Word MC: 100%

The peg tube is removed.



PATIENT AT DISCHARGE



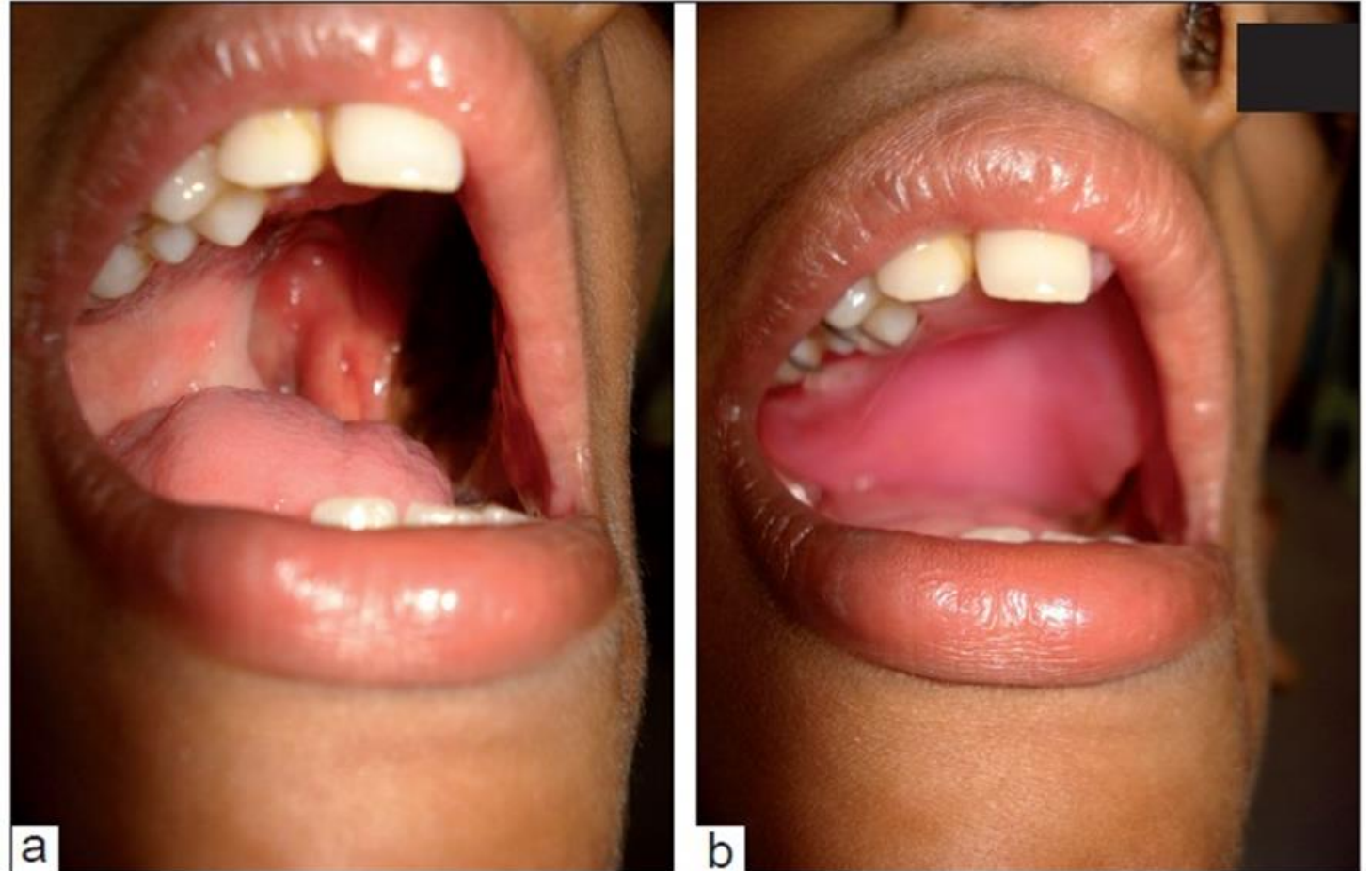
SURGERY TYPES FOR ORAL CANCER

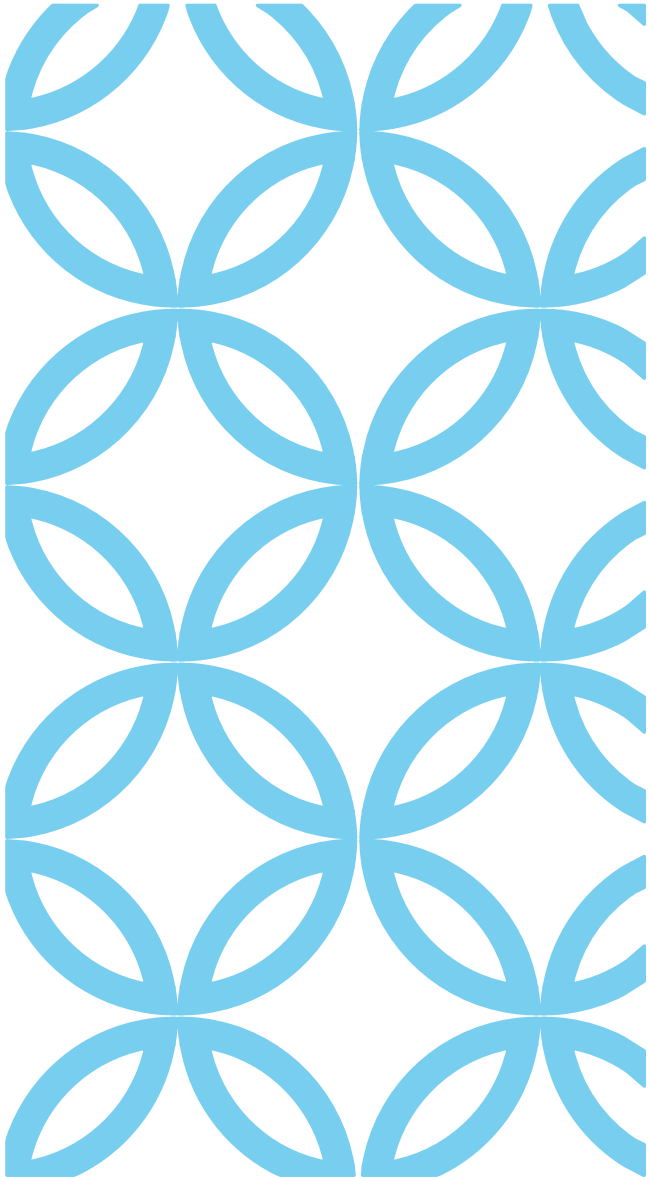
Maxillectomy

Removal of the hard palate, and bone of the maxilla.

Includes any teeth

Can be reconstructed with a free flap of an obturator





Usually started on clear fluids POD 1 if they have an obturator. The obturator will have packing above it and may be screwed into the remaining palate

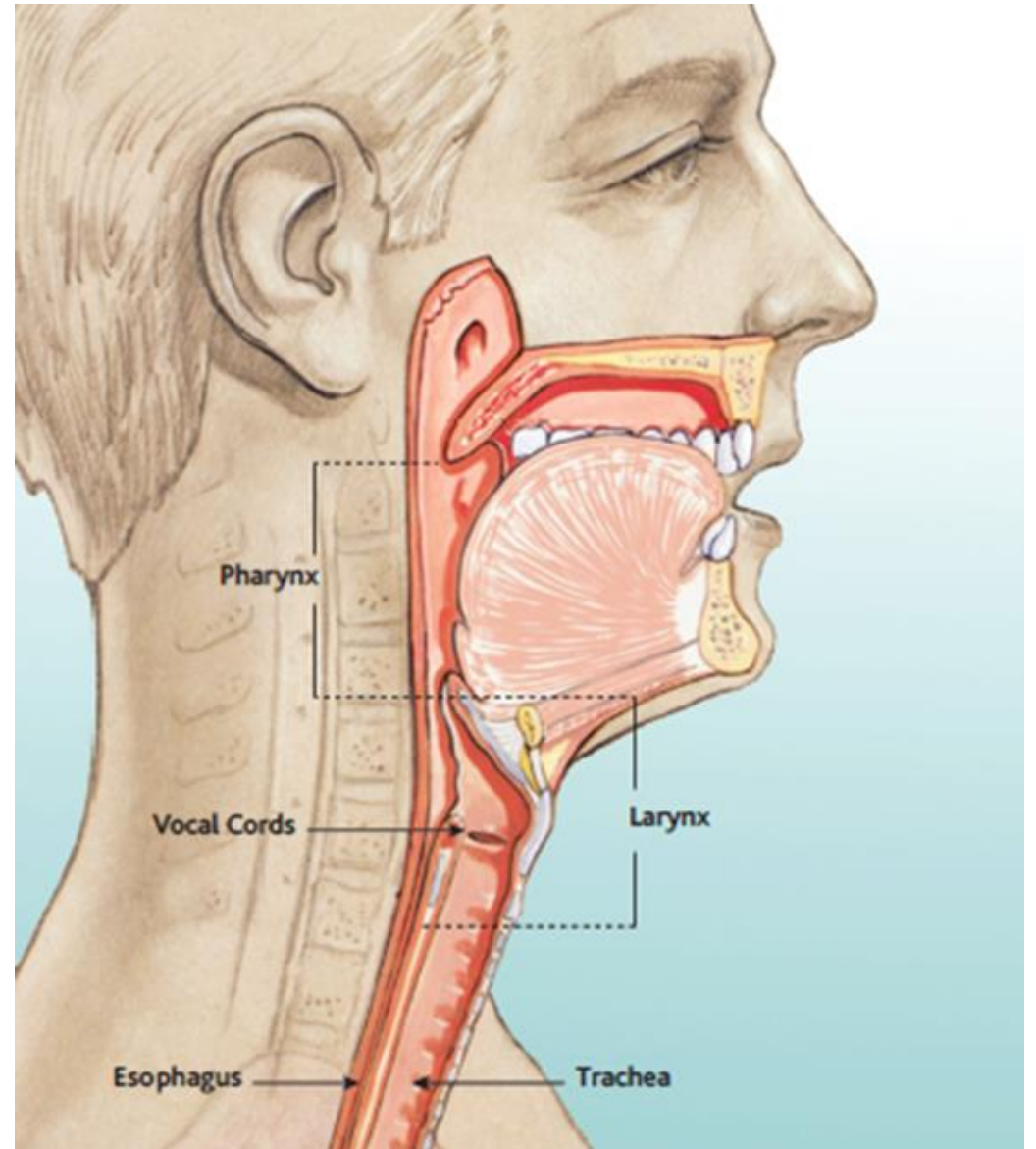
This screw is removed one week post op at times in the clinic when the packing is removed.

May be upgraded to full liquids before discharge.

If radiation is needed post ensure they are educated on trismus and it's s/s and management.

MAXILLECTOMY

PRE- LARYNGECTOMY

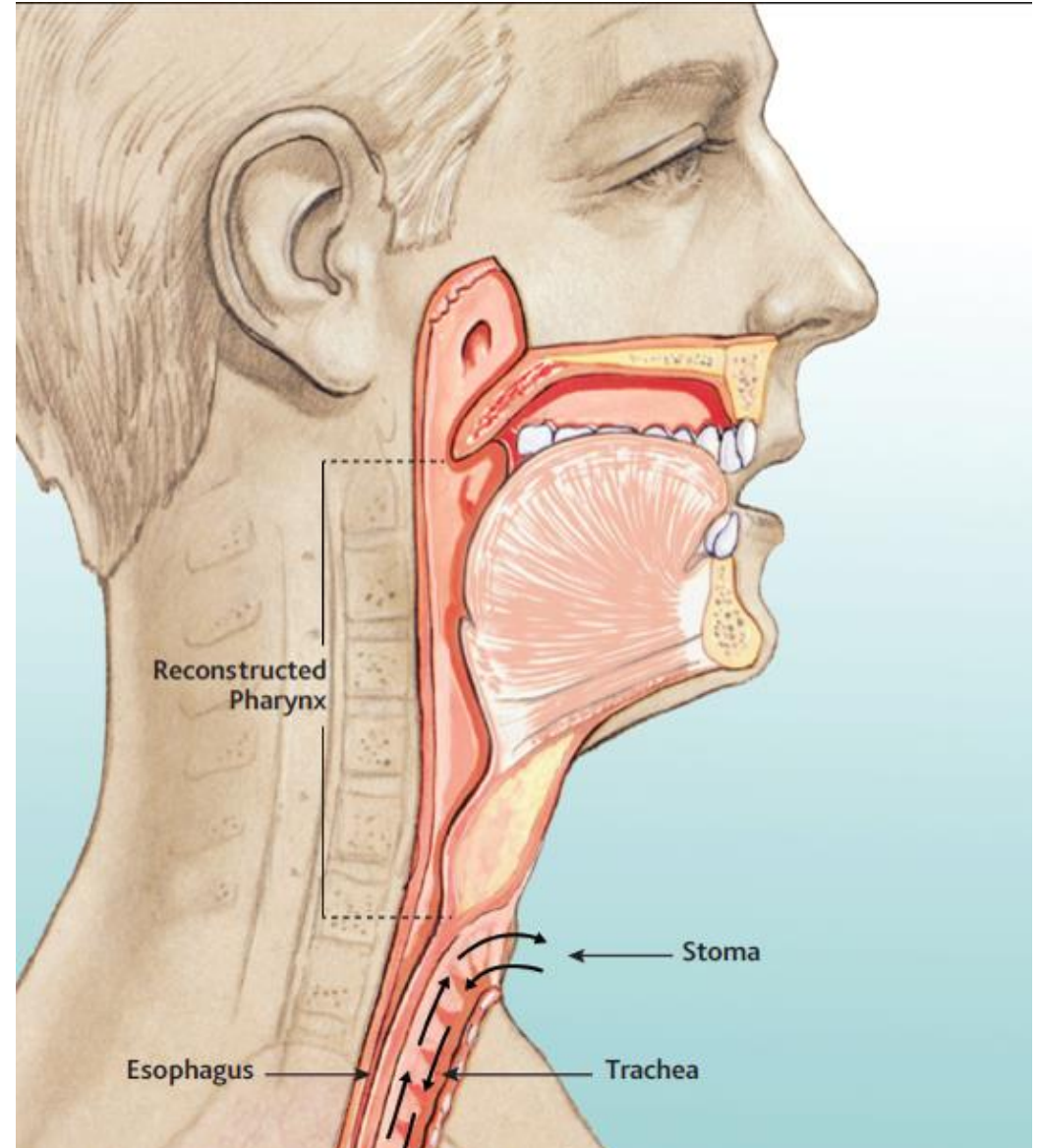


POST TOTAL LARYNGECTOMY

The larynx is removed and the trachea is advanced and sutured to the skin. This creates a stoma and effectively removes the connection between mouth/nose and the lungs.

The only way for the patient to breath is through the stoma

Pharyngoesophageal (PE) segment is made up of the inferior fibers of the inferior pharyngeal constrictors, cricopharyngeus and upper fibers of the esophagus, approximately C-5 to C-6



LARYGTUBES VS TRACHEOSTOMY TUBES

Tracheostomy Tube



Larytube



LARYNGECTOMY TUBES/ STOMA BUTTONS

ATOS LaryTubes can hold the HME and may be fenestrated, non fenestrated or with a blue ring to use with Optiderm adhesive

Lengths: 27, 36 and 55

Diameter: 8, 9, 10, 12

Life and Legacy Lary Tubes are avail.



Images courtesy of Atos Medical



Inhealth Laryngectomy Tubes may be fenestrated or non fenestrated

Lengths: 36 and 55

Diameter: 8,9,10,12



Barton Mayo Button

OD 9,10,12,14

Length: short, regular, long

Images courtesy Inhealth Technologies

Larybutton sizes:

OD 12, 14, 16,18

Length: 8 or 18mm

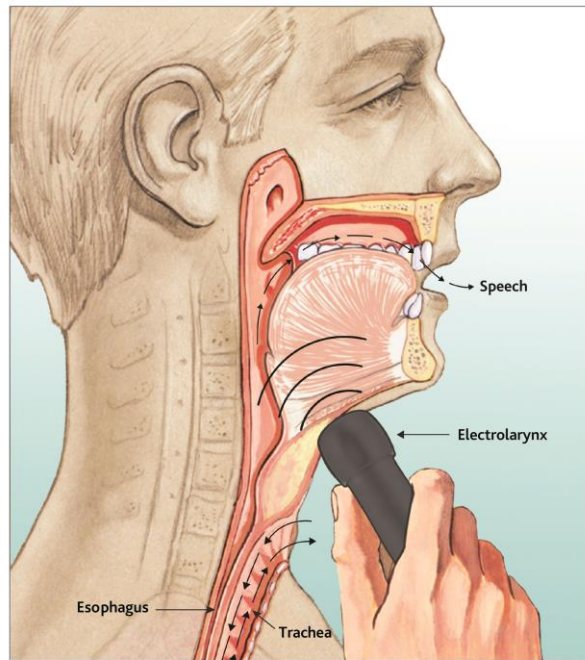


PLACING A LARYNGECTOMY TUBE



WAYS TO COMMUNICATE POST TOTAL LARYNGECTOMY

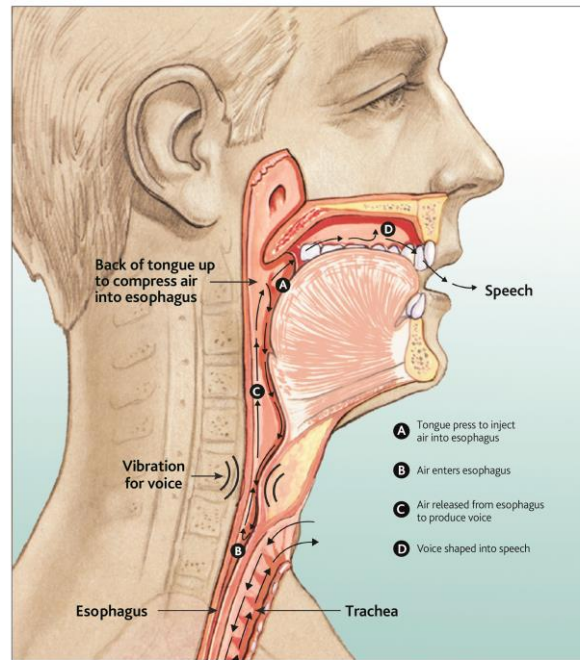
Artificial Larynx



Notes: _____

INHEALTH
 TECHNOLOGIES
Blom-Singer

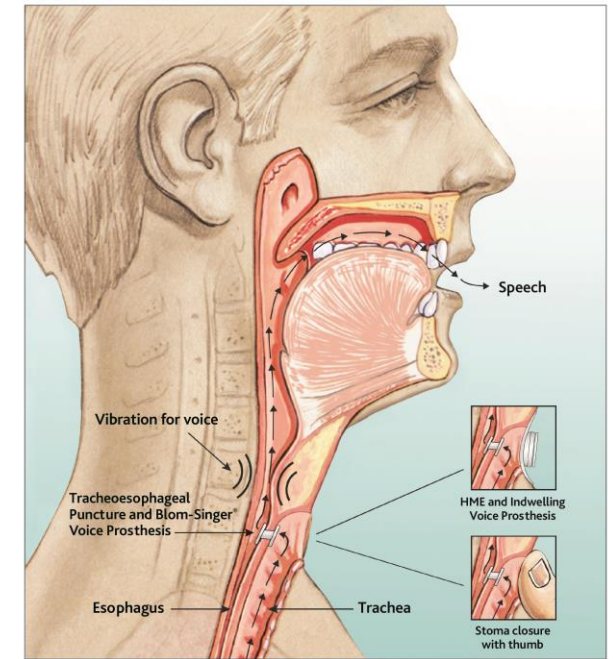
Esophageal Speech



Notes: _____

INHEALTH
 TECHNOLOGIES
Blom-Singer

Tracheoesophageal Voice Prosthesis

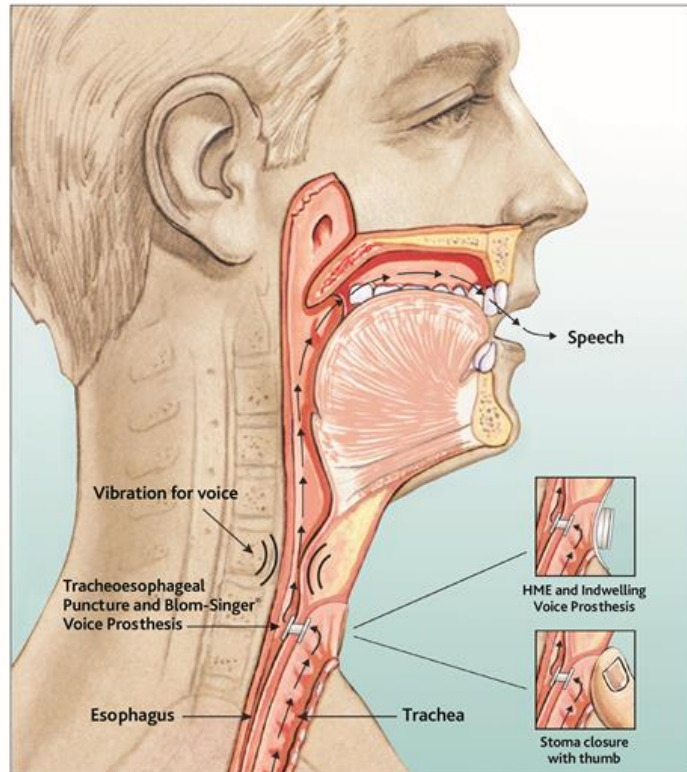


Notes: _____

INHEALTH
 TECHNOLOGIES
Blom-Singer

TRACHEOESOPHAGEAL VOICE PROTHESIS

Tracheoesophageal Voice Prosthesis



Notes:

INHEALTH
TECHNOLOGIES

Blom-Singer

Reorder # TA1024

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38-010-01 Rev. B



TRACHEOESOPHAGEAL VALVE LEAKAGE



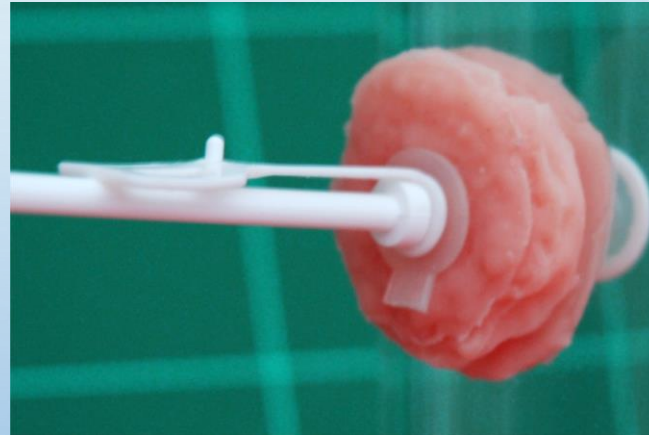
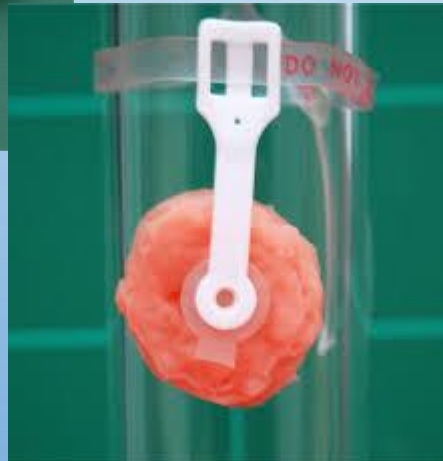
Periprosthetic
Leakage

CLEANING A VALVE

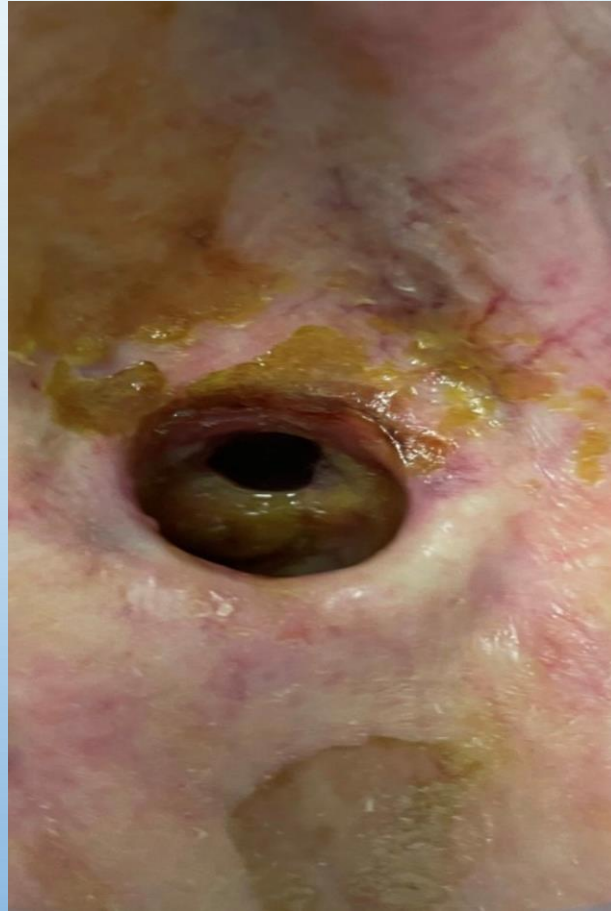


WHAT TO DO ABOUT LEAKAGE

- IF LEAKAGE IS THROUGH THE MIDDLE OF THE VALVE
 - USE A PLUG – EVERY PATIENT SHOULD HAVE A PLUG
- IF LEAKAGE IS AROUND TRY THICKENING THE FLUIDS



EMERGENCY SITUATIONS



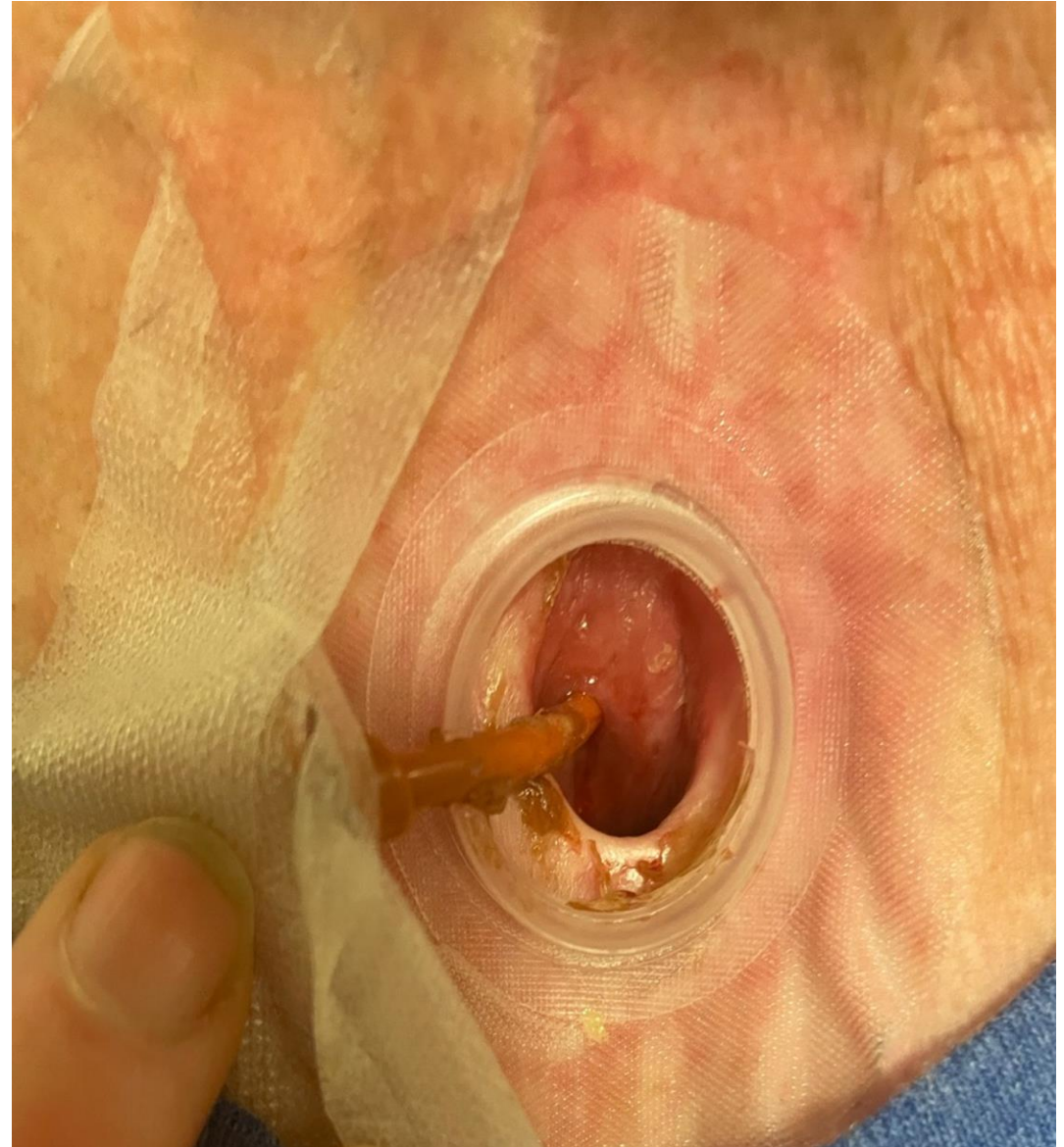
WHAT TO DO ABOUT A MISSING VALVE

NPO- do not feed these patients as there is now a communication from the esophagus into the trachea.

Place a red rubber catheter through the puncture (tie a knot in the end so gastric juices do not come through). This saves the puncture tract and will prevent saliva from being aspirated.

Send to center with SLP or MD who can place the valve.

Get a chest x-ray to determine if the valve has been aspirated into the lung if they do not have the valve in their hand



EMERGENCY SITUATIONS



Valve has eroded through the tracheoesophageal wall.

This will need to be assessed by a surgeon and may need to be removed under sedation

WEATHERSPOON, D. J., CHATTOPADHYAY, A., BOROUMAND, S., & GARCIA, I. (2015). ORAL CAVITY AND OROPHARYNGEAL CANCER INCIDENCE TRENDS AND DISPARITIES IN THE UNITED STATES: 2000–2010. *CANCER EPIDEMIOLOGY*, 39(4), 497-504.

HUTCHENSON USE IT OR LOSE IT, JAMA-OTO 2013

BARBON, C. E., PETERSON, C. B., MORENO, A. C., LAI, S. Y., REDDY, J. P., SAHLI, A., ... & HUTCHESON, K. A. (2022). ADHERING TO EAT AND EXERCISE STATUS DURING RADIOTHERAPY FOR OROPHARYNGEAL CANCER FOR PREVENTION AND MITIGATION OF RADIOTHERAPY-ASSOCIATED DYSPHAGIA. *JAMA OTOLARYNGOLOGY–HEAD & NECK SURGERY*, 148(10), 956-964.

VIRANI A, KUNDUK M, FINK D, MCWHORTER A. EFFECTS OF 2 DIFFERENT SWALLOWING EXERCISE REGIMENS DURING ORGAN-PRESERVATION THERAPIES FOR HEAD AND NECK CANCERS ON SWALLOWING FUNCTION. *HEAD AND NECK*. 2015; 37(2):162–170

VAN DER GEER ET AL (2018)

DOELTGEN, SH., ET AL, BIOMECHANICAL QUANTIFICATION OF MENDELSON MANEUVER AND EFFORTFUL SWALLOWING ON PHARYNGOESOPHAGEAL FUNCTION. [OTOLARYNGOL HEAD NECK SURG.](#) 2017 NOV;157(5):816-823

CARNABY-MANN, G., CRARY, M. A., SCHMALFUSS, I., & AMDUR, R. (2012). "PHARYNGOCISE": RANDOMIZED CONTROLLED TRIAL OF PREVENTATIVE EXERCISES TO MAINTAIN MUSCLE STRUCTURE AND SWALLOWING FUNCTION DURING HEAD-AND-NECK CHEMORADIOTHERAPY. *INTERNATIONAL JOURNAL OF RADIATION ONCOLOGY* BIOLOGY* PHYSICS*, 83(1), 210-219

RAPIDIS, ALEXANDER D., ET AL. "TRISMUS IN PATIENTS WITH HEAD AND NECK CANCER: ETIOPATHOGENESIS, DIAGNOSIS AND MANAGEMENT." *CLINICAL OTOLARYNGOLOGY* 40.6 (2015): 516-526.

MASAKO F, LOGEMAN J. EFFECT OF A TONGUE-HOLDING MANEUVER ON POSTERIOR PHARYNGEAL WALL MOVEMENT DURING DEGLUTITION *AMERICAN JOURNAL OF SPEECH-LANGUAGE PATHOLOGY*, 1996, VOL. 5, 23-30

VAN DER GEER, S. J., VAN RIJN, P. V., ROODENBURG, J. L., & DIJKSTRA, P. U. (2020). PROGNOSTIC FACTORS ASSOCIATED WITH A RESTRICTED MOUTH OPENING (TRISMUS) IN PATIENTS WITH HEAD AND NECK CANCER: SYSTEMATIC REVIEW. *HEAD & NECK*, 42(9), 2696-2721